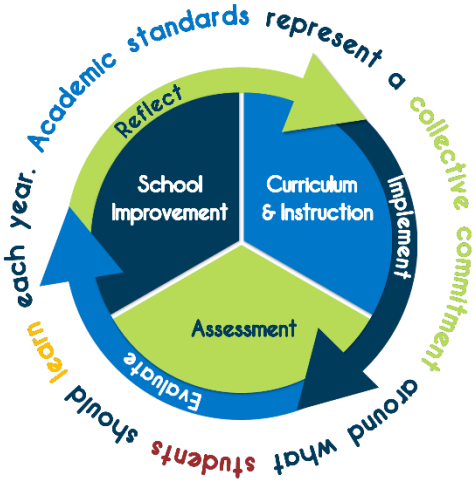
ILLINOIS STATE BOARD OF EDUCATION

MATHEMATICS HIGH SCHOOL NUMBER & QUANTITY

Samples to Success



Sample items provide valuable insight into how students engage with different texts, tasks, and contexts by highlighting the types of opportunities they need for success in the classroom. These items offer a shared reference point for understanding proficiency expectations, complementing the assessment's role in measuring learning. Analyzing items alongside performance data can enable educators to gain a deeper understanding of students' strengths and areas for growth. Students thrive in environments rich with diverse materials, challenges that vary in task type, and multiple avenues for demonstrating understanding. High-quality instruction, aligned with the learning goals, is the most effective way to support students' growth and prepare them for success.

The sample questions included in this rubric are a blend of those typical of the ACT and others that are suitable for classroom instruction, aimed at reinforcing and developing the skills assessed on the ACT. The number and quantity category requires students to demonstrate knowledge of real and complex number systems. Students will show understanding by reasoning with numerical quantities in many forms, including integer and rational exponents, vectors, and matrices. This document contains ACT items and includes excerpts from ACT aligned guides: © ACT Education Corp.

Number and Quantity

Below Proficient	Approaching Proficient	Proficient	Above Proficient
For all nonzero values of a, the expression $\frac{a^2a^4}{a^6}$ is equal to: A. 0 B. 1 C. a D. a^2 E. a^{12}	Let $z = 4 + 5i$ and $w = 3 + 7i$, where i is the imaginary unit. What is the value of $2z + w$? A. -28 B. $28i$ C. $11 + 12i$ D. $11 + 17i$ E. $14 + 24i$	One of the following values for a makes the expression $\frac{2a+5}{a^2+1}$ undefined. Which one? A. -3 B. $-\frac{5}{2}$ C. -1 D. 0 E. i	For what positive real value of k, if any, is the determinant of the matrix $\begin{bmatrix} k & 4 \\ 3 & k \end{bmatrix}$ equal to k? (Note: The determinant of matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ equals $ad - bc$.) A. 3 B. 4 C. 12 D. $\sqrt{12}$ E. There is no such value of k.

Below Proficient

Which of the following matrices is equal to $5\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$?

A. $\begin{bmatrix}5 & 2\\3 & 4\end{bmatrix}$

B. $\begin{bmatrix}5 & 2\\3 & 20\end{bmatrix}$

C. $\begin{bmatrix}1 & 10\\15 & 4\end{bmatrix}$

D. $\begin{bmatrix}6 & 7\\8 & 9\end{bmatrix}$

E. $\begin{bmatrix}5 & 10\\15 & 20\end{bmatrix}$

Approaching Proficient

$$5\begin{bmatrix}a\\b\end{bmatrix} = 14\begin{bmatrix}20\\12\end{bmatrix}$$

What is $a + b$?

A. $\frac{41}{5}$

B. $\frac{148}{5}$

C. $\frac{448}{5}$

D. 29

E. $\frac{191}{4}$

Proficient

The vector i represents 1 mile per hour east, and the vector j represents 1 mile per hour north. Maria is jogging south at 12 miles per hour. One of the following vectors represents Maria's velocity, in miles per hour. Which one?

A. $-12i$

B. $-12j$

C. $12i$

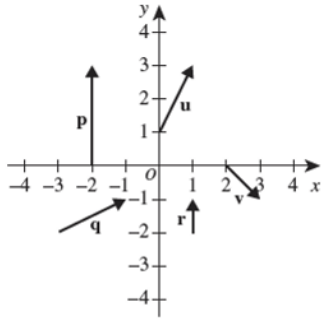
D. $12j$

E. $12i + 12j$

Above Proficient

Representatives of vectors u, v, p, q, and r are shown in the standard (x, y) coordinate plane below.

One of the following vectors is equal to the vector $u + v$. Which one?



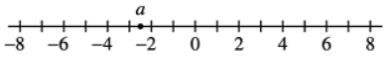
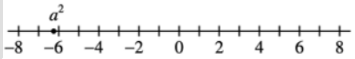
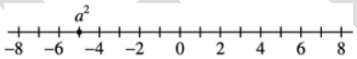
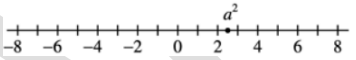
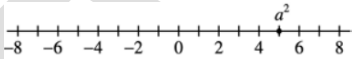
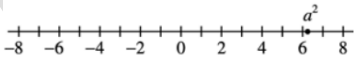
A. $-r$

B. $-q$

C. $-p$

D. p

E. q

Below Proficient	Approaching Proficient	Proficient	Above Proficient
The lead of a screw is the distance that the screw advances in a straight line when the screw is turned 1 complete turn. If a screw is 2 inches long and has a lead of $\frac{1}{8}$ inch, how many complete turns would get it all the way into a piece of wood? A. 2 B. 8 C. 10 D. 16 E. 28	What is the difference between 1.9 and $1.\overline{8}$? (Note: A bar indicates a digit pattern that is repeated.) A. $0.00\overline{1}$ B. $0.0\overline{1}$ C. $0.\overline{1}$ D. 1.0 E. 10.0	The number a is located at -2.5 on the number line below.  One of the following number lines shows the location of a^2. Which number line is it? A.  B.  C.  D.  E. 	If $i = \sqrt{-1}$, then $\frac{i+i^2+i^3}{i^3+i^4+i^5} = ?$ A. -3 B. -1 C. $\frac{1}{2}$ D. 1 E. 3